Dewart Lake Vegetation Management Plan Update

Kosciusko County, Indiana

2007 - 2011

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

Prepared for:

The Dewart Lake Protective Association Inc.
P.O. Box 152
Syracuse, Indiana 46567

Prepared by:

Aquatic Weed Control
P.O. Box 325
Syracuse, IN 46567

Executive Summary

Eurasian Watermilfoil (EWM) was still undetectable in Dewart Lake in August of 2007. A visual survey was conducted on June 13, 2007 for the presence of EWM, and a late season Tier II survey was conducted on August 15, 2007 to monitor both native and invasive plant populations following the whole lake Sonar treatment in 2006. These surveys found no EWM plants in the lake. Sago pondweed, a beneficial native plant had become dominant in many areas previously infested by EWM.

The entire lake was treated with Sonar (active ingredient: fluridone) on May 26, 2006. This treatment was designed to drastically reduce the Eurasian watermilfoil (EWM) population and allow native plants to colonize areas where the milfoil was previously dominant. Two separate vegetation surveys were conducted on Dewart Lake in August of 2006 after the chemical treatments. One survey was conducted by District 3 Fisheries Biologist Jed Pearson. The other was conducted by Aquatic Weed Control. Eurasian watermilfoil was not found in either survey. The chemical treatment was successful in reducing the Eurasian watermilfoil to the point that it was undetectable in late summer of 2006.

In 2007, no herbicide treatments of any kind were conducted on Dewart Lake. This allowed for native plants to re-establish themselves after the 2006 whole lake Sonar treatment.

The 2007 late season vegetation survey showed that many native plants were re-establishing themselves, and that Eurasian watermilfoil was still undetectable in Dewart Lake. Aside from EWM the biggest population changes were seen in the coontail and sago pondweed populations. Coontail site frequency dropped from 43.3% in 2006 to 5.6 % in 2007. Sago pondweed frequency increased from 4.4% in 2006 to 28.9% in 2007.

Funding should be set aside to treat of areas of Eurasian watermilfoil (EWM) re-growth, as some re-growth is expected in 2008. Areas of re-growth may be treated with Renovate or 2, 4-D herbicide.

*All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.

1. Chemically treat areas of Eurasian milfoil growth
   A. Treat up to 20 acres for Eurasian milfoil with Renovate or 2, 4-D $9,500

2. Conduct a spring visual survey and late season aquatic vegetation survey to monitor both Eurasian milfoil and native plant populations.

   A. Aquatic Vegetation Surveys and Plan Update Up to $6,000

Acknowledgements

Aquatic vegetation surveys conducted on Dewart Lake were made possible by funding from the Dewart Lake Protective Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. Brad Fink, and Jason Doll provided assistance and training for data analysis computer programs. Aquatic Weed Control would also like to thank the members of the Dewart Lake Protective Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on June 10, 2006.

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1.0 Introduction

Dewart Lake has been involved in the Lake and River Enhancement Program (LARE) since 2005, when the first LARE funded aquatic vegetation survey took place on May 19, 2005. Based on the results of the 2005 surveys, a whole lake Sonar treatment was conducted in the following spring on May 26, 2006 for the control of Eurasian watermilfoil. The treatment was successful, and Eurasian milfoil was not found in the late season plant surveys of 2006. In 2007, no herbicide treatments were conducted on the main lake, giving native plants a chance to re-colonize areas of previous EWM infestation. A late season vegetation survey was conducted by Aquatic Weed Control on August 15, 2007. This survey found that EWM was still absent from the lake, and that sago pondweed, a beneficial native plant, had become dominant in many areas previously infested by EWM. Table 1 summarizes all LARE funded activities on Dewart Lake.

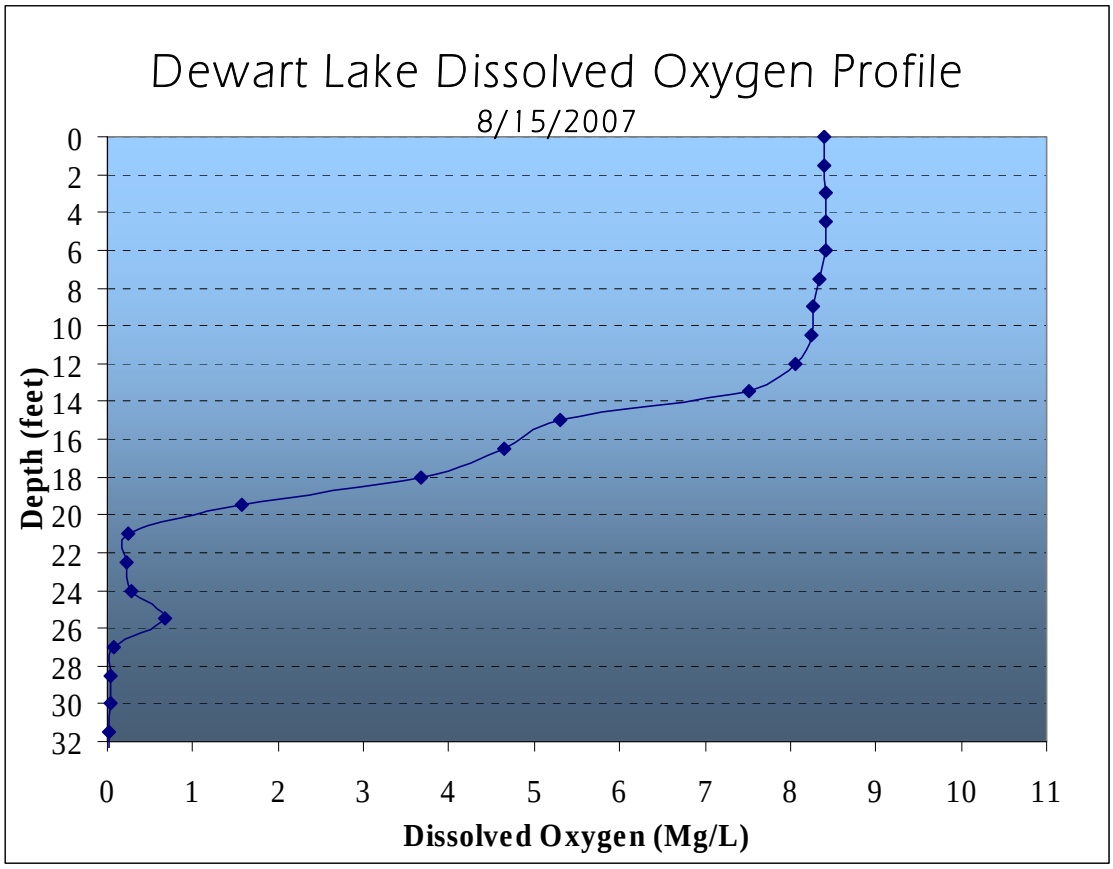
Table 1: Dewart Lake LARE History

Year	Action	Date	Funding Source
2005	Spring and Late Season Aquatic Vegetation Surveys Management Plan Development	Spring Survey May 19, 2005 Late Season Survey July 27, 2005	Lake and River Enhancement Dewart Lake Protective Association
2006	Whole Lake Sonar Treatment Aquatic Vegetation Surveys and Management Plan Update	Spring Survey May 18, 2006 Sonar Treatment May 26, 2006 Late Season Survey August 10, 2006	Lake and River Enhancement Dewart Lake Protective Association
2007	Visual Vegetation Survey for EWM No herbicide Treatments allowed to allow native plants to re-establish Late Season Aquatic Vegetation Survey	Visual Survey June 13, 2007 Summer 2007 Late Season Survey August 15, 2007	Lake and River Enhancement Dewart Lake Protective Association

2.0 Watershed and Lake Characteristics Update

Secchi depth was measured at 7.8 feet in Dewart Lake on August 15, 2007. Although water level was not measured, water level observations appeared somewhat higher than in 2006 when residents estimated that the lake was between 1 and 3 feet below normal. On August 15, 2007 Aquatic Weed Control measured dissolved oxygen and temperature throughout the water column in Dewart Lake. This data was used to construct dissolved oxygen and temperature profiles for Dewart Lake.

Figure 1: Dewart Lake Dissolved Oxygen Profile

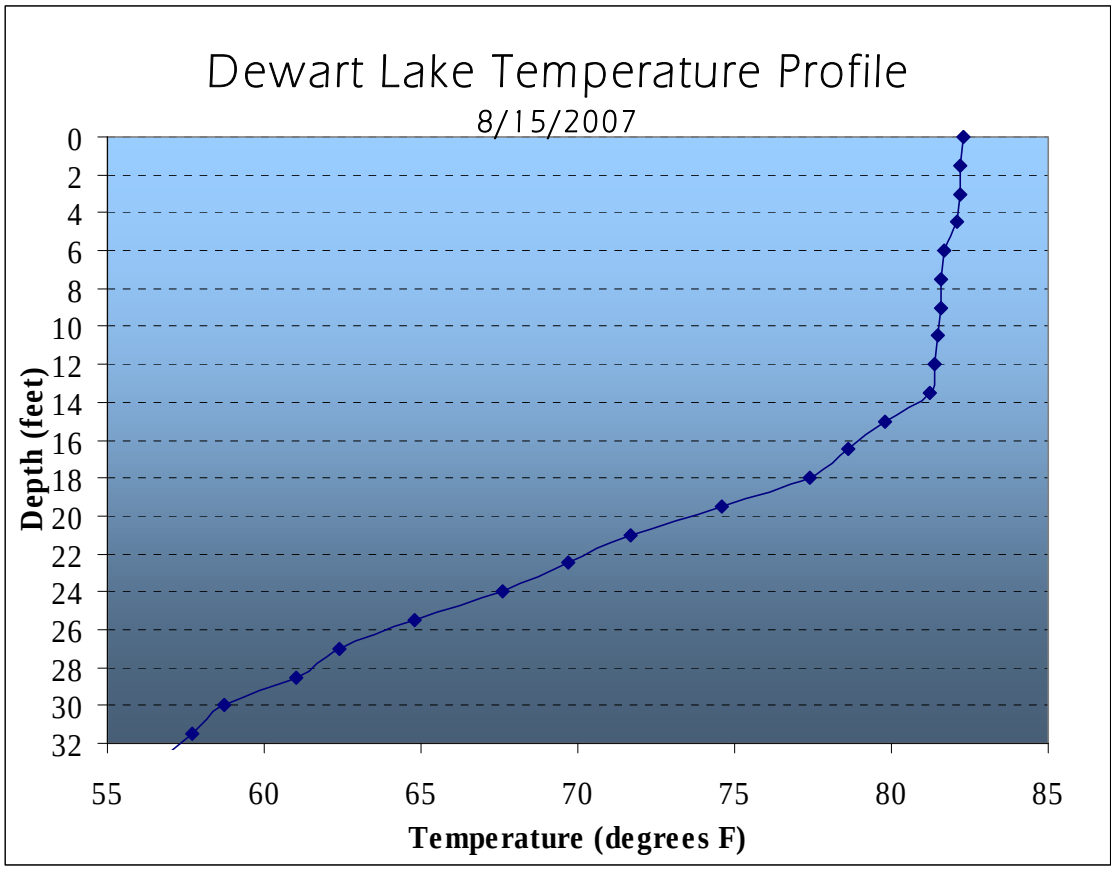


Dissolved oxygen requirements to maintain healthy fish populations of warm-water species are at least 2-5 mg of oxygen per liter of water, while cold-water fish species require 5-9 mg of oxygen per liter of water (Kalff, 2002, p237).

The metalimnion is the transition zone between the surface water and the deep water. It is usually accompanied by rapid changes in dissolved oxygen and temperature. The metalimnion in Dewart Lake is between 12 and 20 feet, characterized by a rapid loss of dissolved oxygen. On August 15, 2007, Dewart Lake had adequate oxygen to support fish life down to roughly 18 feet.

Figure 2 shows water temperature data for Dewart Lake.

Figure 2: Dewart Lake Temperature Profile



The thermocline is a rapid temperature change associated with the transition from surface water to deep water. In Dewart Lake water temperature remains stable from the surface down to 14 feet. Temperature then drops rapidly with depth. This indicates a thermocline at around 14 feet.

3.0 Lake Uses Update

A creel Survey was recently completed on Dewart Lake. The following paragraphs were provided as part of a fish management report by the IDNR designed to monitor conditions at Dewart Lake in response to the whole lake Sonar treatment. This is an excerpt and not the entire report.

Fish Management Report with Emphasis on Lake-Wide
Application of Fluridone to Control Eurasian Watermilfoil
Jed Pearson

Whether the fluridone treatment had any immediate effect on fishing at Dewart Lake was not determined. Until 2006, the only previous information on fishing activity at the lake was obtained by monitoring a bass fishing tournament on

May 19, 2002. At the time, 15 anglers fished a total of 128 hours but brought only five legal-size bass to the weigh-in. All were less than 18 inches. During the 2006 creel survey, however, anglers fished 23,980 hours (44 hrs/ac) from April 3 through October 25. Of the total effort, anglers who fished on weekend accounted for 55% of the total, while anglers on weekdays accounted for 45% (Table 12). Months of greatest fishing activity were June (5843 hrs) and July (5288 hrs). Fishing effort in the spring months of April and May accounted for 7% and 15% respectively. Effort in the fall months of September and October made up 10% and 5% respectively. Summer effort in June, July and August totaled 63%. Like other area lakes, nearly all of the fishing effort came from angler fishing from boats (97%). Shore anglers accounted for only 3%.

Anglers fished mostly for bluegills and bass (Table 13). Those who targeted only bluegills accounted for 36% of the total and those who targeted only bass accounted for 32%. Another 6% fished for bluegills in combination with sunfish, 5% fished exclusively for pike, while 4% fished for bass and bluegills, and 4% fished for "anything". Less than 1% fished for walleyes. Among the total number of responses, bluegills were mentioned more often at 42%, bass second at 34%, sunfish third at 8%, pike fourth at 7%. The percentages of responses from boat anglers for these species were 41%, 34%, 8%, and 8%. Boat anglers tended to target bluegills more in the months of June (47%), July (49%) and August (49%) than other months, while bass responses were highest in April (38%), September (42%) and October (46%). Crappies were mentioned more often in April (8%). Pike were mentioned more often in April (11%) and September (12%).

Multiplying the percentage of responses from boat anglers each month times the number of boat angling hours per month provided an estimate of the monthly fishing effort directed at each species by boat anglers (Table 14). Boat anglers fished 9,705 hours for bluegills and 7,677 hours for bass. Over half of the effort directed at bluegills occurred in June (27%) and July (24%). Only 4% of the bluegill effort occurred in April, while 11% occurred in May. Among boat anglers who fished for bass, peak effort occurred in July (1,733 hrs) and accounted for 23% of the bass fishing total. Hours spent fishing for bass in April (581) and May (1,162) together accounted for another 23%, so even though the percentages of boat anglers who said they were fishing for bass in April (38%) and May (35%) were higher than percentages for other species in these months, their effort represented only 7% and 15% of the total bass effort from boat anglers. Likewise, the effort directed at pike by boat anglers was greatest in June (318 hrs), July (398 hrs), and August (369 hrs) even though as a percentage more effort was directed at pike in April (11%) or September (12%).

Anglers removed 16,266 fish during the period covered by the creel survey (Table 15). Boat anglers took 98% of them. As many as 9,848 bluegills were taken. Sunfish ranked second with 4,419, followed by crappies (538), pike (489), rock bass (312), perch (285), 31 smallmouth bass, 30 walleyes and 14 bullheads. Fishermen removed 299 largemouth bass, 10 of which were marked, and they released 8,865 bass of which 6,729 (76%) were less than 14 inches and 2,136 (24%) were legal-size. Most of the bluegills, sunfish, pike, and rock bass were taken in June. Crappie and smallmouth bass catches peaked in July, while perch and walleye catches peaked in August. Of the 299 largemouth bass removed by anglers, 5% were taken in April, 26% were taken in May, 22% in June, 23% in July, 19% in August, 3% in September, and 2% in October. The highest number of releases occurred in July (26%). Only 7% of the releases were made in April and 19% were made in May. Shore anglers took home mostly bluegills and sunfish.

Harvested bluegills ranged in length from 4.0-9.5 inches (Table 16). The largest percentage (29%) was 7.5 inches. Another 22% were 8-inch or larger. Harvested crappies were 7.0-14.5 inches, with 10 inches the dominant size. Sunfish, mostly redear, were 5.0-12.0 inches, of which 69% were 8-inch and larger. Perch were mostly 7.0-8.5 inches and rock bass were mostly 8.0-9.0 inches. All pike observed by the creel clerk were legal-size (20-in or larger). They ranged up to 37 inches long. Those less than 30 inches accounted for 89% and those 30 inches or larger accounted for 11%. Harvested walleyes were 14.5-23.5 inches. Of the 299 largemouth bass taken home, all but four were legal-size (14 in). Of all legal bass, 59% were less than 16 inches and only 4% were 18-inch or larger. The remaining 37% were 16.0-17.5 inches. The 295 legal-size largemouth bass removed by anglers represented 44% of the original 672 estimated to be present in spring. This figure, however, may be high since some bass less than 14 inches long probably grew into the legal-size range during the period covered by the survey and were taken by anglers. On the other hand, only 10 legal bass (7%) were taken by anglers out of the 134 marked and released into the population. Small sample size and failure to note marked bass in the creel could have biased this figure, however. In contrast, the catch-and-release of 8,865 bass represented more than twice the estimated number (3,578) of all 8-inch and larger bass in the lake. With annual survival of age-5 and older bass estimated at 31%, total annual mortality would be 69%. Assuming fishing mortality was a high as 44%, another 25% of the adult bass population (age-5 and older) could be lost each year to natural causes and delayed mortality due to angler catch-and-release. If fishing mortality is indeed as low as 7%, unexplained mortality could be as high as 62%.

Anglers were generally satisfied with fishing quality (Table 17). Overall, 74% of the responses of interviewed anglers were ‘good’, 20% were ‘fair’, and 6% were ‘poor’ when asked to describe fishing quality at Dewart Lake. Similar percentages of anglers rated bluegill and bass fishing as good (72-73%), while similar percentages (6-7%) of both groups rated fishing as poor. Anglers who specifically targeted only bluegills harvested them at the rate of 0.78 per hour. Those who considered fishing ‘good’ (70%) harvested them at the rate of 0.93 per hour and those who considered fishing ‘poor’ harvested them at 0.50 per hour. Of the 420 interviewed parties (835 anglers) who sought only bluegills, 202 parties (48%) representing 385 individuals (46%) took home none. In contrast, only four fishermen in three parties (<1%) kept 25 or more bluegills, per angler including only one person who took home more than 25. Forty-three parties (10%) kept 10 or more bluegills per angler. Those who fished specifically for bass caught them at the rate of 0.89 per hour but took home only one bass per 111 hours of fishing. Their catch rate of sub-legal bass was 0.55 per hour. Most anglers who fished only for bass rated fishing as ‘good’ (72%) and only 5% rated fishing as ‘poor’. Northern pike were even more satisfied, with 80% of the responses ‘good’ and only 4% ‘poor’. Crappie anglers were less satisfied with fishing quality (68% good, 10% poor) and perch anglers and anglers who fished for “anything” were least satisfied.

Prior to the fluridone application, anglers had mixed opinions on whether there were “too many weeds” in Dewart Lake, but no one thought so afterwards (Table 18). From April through June, the percentage of anglers who thought there were too many weeds varied from 31-40% per month, while the percentage who did not varied from 47-59%. About 10-13% were unsure. The percentage of anglers who thought there were too many weeds dropped to 16% in July, 3% in August, and to 0% by September. The percentage who did not think there were too many weeds increased to 75% in July, 96% in August, and 100% by September. Before treatment, lake residents were more likely to think there were too many weeds than lake visitors. Visitors were also less certain there were too many weeds. By August, there were no differences in opinions between residents and visitors.

Perceptions of a weed problem varied with angler preferences. Among boat anglers overall, those who fished for 'anything' or crappies were more likely (35-36%) to think there were too many weeds in the lake (Table 19). Bluegill and sunfish anglers were less likely (20-27%), while bass and pike anglers were the least likely to think there were too many weeds (11-15%). However, these figures do not take into account their reaction to the decline in vegetation associated with the fluridone application throughout the season. For example, bluegill anglers in April, May and June were initially more likely to say there were too many weeds than did bass or pike anglers, but by August, September and October even bluegill anglers agreed there were no longer too many weeds in the lake (Table 20). Angler perceptions of a weed problem were not related to their perceptions of fishing quality (Table 21).

4.0 Fisheries Update

A new fisheries survey was recently completed on Dewart Lake. The following paragraphs were provided as part of a fish management report by the IDNR designed to monitor conditions at Dewart Lake in response to the whole lake Sonar treatment. This is an excerpt and not the entire report.

Fish Management Report with Emphasis on Lake-Wide Application of Fluridone to Control Eurasian Watermilfoil
Jed Pearson

"As expected, given the May application of the fluridone treatment and the unlikelihood of any immediate impact, results of the June and July fish population surveys were similar to results obtain in previous years (Table 5). Bluegills have consistently ranked first by number in survey catches dating back to 1976. Largemouth bass, redear and yellow perch have also been the major sport species over the years. The most notable change in relative abundance of various species, however, has been the appearance and eventual increase of northern pike after 1982. Fifty-nine pike, weighing 144 pounds, were caught during the 2006 sampling. Pike accounted for 26% of the total survey weight. The gill net catch rate increased from 4.3/lift in 1995 to 6.8/lift in 2003 and 7.3/lift in 2006. As pike abundance increased, smallmouth bass and walleyes were also stocked, although only two smallmouth bass and seven walleyes were captured in the 2006 survey. The overall weight of large predators (including largemouth bass, gar and bowfin) increased from an average of 38% in 1976 and 1982 to 60% in 1995 to 2006, even though they accounted for only 9-13% by number.

Whether in response to size limits imposed in the 1990s, largemouth bass abundance was no greater in 2006 than in previous years, based on survey catches. A total of 152 bass were caught in the 2006 survey, although 118 were caught in June (26/15-min) and only 34 (18/15-min) in July. The July catch rate was similar to the catch rate in 1995 (18/15-min) and 2003 (14/15-min). Comparisons of largemouth bass abundance to 1976 and 1982 were compounded by the use of AC electrofishing gear in 1976 and 1982, then DC electrofishing gear afterwards. Mean weight of bass ranged from 0.35-0.37 pounds in 1976 and 1982, increased to 0.62 in 1995, but then dropped back to 0.48 in 2003 and to 0.40 in 2006.

As predator fish increased at Dewart Lake, populations of other fish may have decreased (Table 5). Only eight black crappies were caught in 2006, including only three in July. No golden shiners were observed, although as many as 30 were caught in 1976. Only four lake chubsuckers were caught in July 1995, 2003 or 2006 compared to 142 in 1976. Pumpkinseeds, redfin pickerel, and white suckers were noted in previous surveys but not captured since 1995. As many as

107 yellow perch were caught in 2006, but only 22 were taken in July, while earlier July surveys included 65 to 136 perch. Despite the declines among these forage species, four banded killifish, 16 brook silversides, eight logperch, and 249 mimic shiners (perhaps identified as bluntnose minnows in 1995) were caught in the latest survey, while bullhead catches and catches of other sunfish species (green, longear, pumpkinseed, rock bass, warmouth) were similar to previous surveys.

A total of 1,159 bluegills were sampled during the 2006 survey, ranging in length from 1.7-8.5 inches. Mean length of bluegills in the July 2006 catch was 3.5 inches, down from 5.3 in 1976 and 5.0 in 1982, but also down from 3.9 and 4.0 in 1995 and 2003, indicating bluegill size may have declined over the past 30 years, although prior to 1995 (Table 6). From 1995 through 2006, DC electrofishing catch rates (123-134/15-min) and size structure indices of bluegills, however, have been relatively stable. Less than 1% of all 3-inch and larger bluegills have been 8-inch or larger.

The 152 largemouth bass collected during the June and July sampling ranged in size from 2.5-17.5 inches (Table 7). Although 10 were 14.0-14.5 inches, only one was larger at 17.5 inches. Of all bass 8 inches and larger, 15% were 14-inch or larger. The percentage was slightly greater in June (16%) than July (12%). The proportion of 14-inch and larger bass in July 2006 (12%) was within the range of values from 1976 through 2003 (6-18%). Mean length in 2006 (4.7 in) was also similar to mean lengths in previous surveys. Although no 18-inch or larger bass were captured during the 2006 survey, very few were caught in earlier surveys as well. Only two were captured in 1995 and one was caught in 2003.

More and larger bass were captured during the four nights of spring mark-recapture sampling at Dewart Lake. A total of 1,282 bass, ranging from 3.0-20.5 inches, were caught in slightly over 13 total hours of sampling (Table 8). In addition, 131 bass from 4.0-18.0 inches were recaptured. The largest numbers of individual and recaptured bass were 6.5-7.0 inches. As many as 149 bass were legal-size. They comprised a greater proportion of all 8-inch and larger bass (18%) than they did in June or July. In addition, 15 bass captured in spring were 18-inch or larger, compared to none in June or July.

The Schnabel population estimate of 8-inch and larger bass was 3,578, or only 6.5 per acre (Table 9). The standard error was 400, providing a 90% confidence interval of 2,922 to 4,327. The overall estimate of all bass, including those less than 8 inches long, was 5,401 (SE=470). Nightly catches of 8-inch and larger bass, including recaptures, obtained during one electrofishing lap around the shore varied from 170-243, or 5-7% of the population. The mean nightly catch per hour of 8-inch and larger bass was 68, 13 per hour of 14-inch and larger bass, and only 1 per hour of 18-inch and larger bass. The mean nightly proportions of 8- to 11.5-inch bass, 12- to 13.5-inch bass, 14- to 17.5-inch bass, 18 inch and larger bass were 59%, 22%, 17% and 2%, respectively. Based on these figures, the estimated numbers of bass in these size groups were 2119, 787, 610 and 62. Although likely underestimated, another 1,823 were less than 8 inches. By the time sampling was complete, 814 bass that were 8-inch or larger had been placed within the population, including 134 that were 14-17.5 inches and 15 that were 18-inch or larger.

Bass captured in spring ranged from age-1 through age-8 (Table 10). Mean length per age was 3.4, 6.7, 8.0, 11.1, 13.5, 15.3, 17.3, and 19.2 inches, respectively, based on weighted averages for all captured fish within each age-group. No age-4 bass had reached legal-size but about 42% of age-5 bass had. Over 90% of age-6 bass were legal-size. Mean back-calculated lengths, based on year-class averages for age-1 through age-6 fish, were 2.9, 6.4, 9.5, 12.1, 14.1, and 15.6 inches (see Appendix) and were similar to lengths reported in previous surveys (Table 11). Given the proportion of the number of bass within each age-group distributed over the size range of all bass estimated to be present in spring (5401), Dewart Lake contained 80, 1411, 1427, 1378, 766, 188, 131, and 21 bass that were age-1 through age-8, respectively. Using these figures, annual survival of bass, age-2 through age-7, was 73%, 64%, 45%, 31%, 45%, and 14%, respectively."

5.0 Problem Statement

Eurasian watermilfoil no longer dominates the Dewart Lake plant community. The challenge in 2008 will be to identify areas of EWM re-growth through proper vegetation survey techniques and manage them effectively with herbicide treatments. Since some EWM re-growth is expected in 2008, spot treatments using 2, 4-D or Renovate should be used to manage these smaller areas, as opposed to a whole lake treatment.

6.0 Management Goals and Objectives

The management goals outlined by the IDNR Division of Fish and Wildlife have not changed. They are restated below:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Specific Objectives

The major objective for Dewart Lake has changed from a large scale treatment effort to reduce the dominant milfoil population, to smaller scale treatments in areas where re-growth is observed in the future.

7.0 Plant Management History Update

District 3 Biologist Jed Pearson was contacted to determine any significant changes to Aquatic vegetation control permits. The only significant change to permits was the whole lake Sonar treatment. No herbicide treatments have been permitted on the main lake since the Sonar treatment.

Dewart Lake was treated with Sonar (active ingredient: fluridone) on May 26, 2006. The amount of Sonar needed to reach a concentration of 6 ppb in Dewart Lake was calculated using the following formula.

Quarts of Sonar = (Total Acres) x (Avg. Depth of Treatment Site) x (0.0027) x (desired concentration)

A total of 28 gallons of Sonar were applied throughout Dewart Lake. The lake was divided into 4 quadrants with equal amounts of herbicide being applied in each quadrant. GPS waypoints were used to ensure adequate coverage of the heaviest Eurasian watermilfoil beds, but sonar was also distributed in deeper water as well to reduce the potential for “hot spots” which is a small area with a very high concentration of fluridone.

The application was completed using 2 boats, each equipped with an underwater high pressure injection system.

In 2007, no herbicide treatments of any kind were conducted on the main lake. This allowed native plants to re-establish themselves. The only area treated in Dewart Lake in 2007 was in the channel system encircling Blueberry Island in the southeast end of the lake. Figure 3 shows this area.

Figure 3: 2007 Private Treatment Area

8.0 Aquatic Plant Community Characterization Update

One major change in protocol for 2007 is the absence of the Tier I reconnaissance survey. Survey intensity is now being tailored to individual lakes, depending on their own unique set of circumstances and management activities. Some lakes which may have been surveyed twice annually in the past may only be surveyed once each season. Surveys on some lakes that have been intensely surveyed in recent years may change to visual surveys as opposed to more time consuming quantitative vegetation surveys. These changes provide better quality of service and more efficient use of funding on Indiana lakes.

An updated Tier II survey protocol has been established by the IDNR. These changes are outlined in the methods section (8.1).

8.1 Methods Update

The Tier II survey protocol was updated by the IDNR in 2007. New LARE Tier II protocol requires that sample sites be stratified by depth contour, and that data analysis be provided for each depth contour. Rake scores for plant species are recorded as 1, 3, or 5, as opposed to the original scoring system of 1, 2, 3, 4, or 5.

The number of sample sites needed for a Tier II survey still is based on both lake size and trophic state, as it was in 2006. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic Lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 2 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 2: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 3 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 3: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

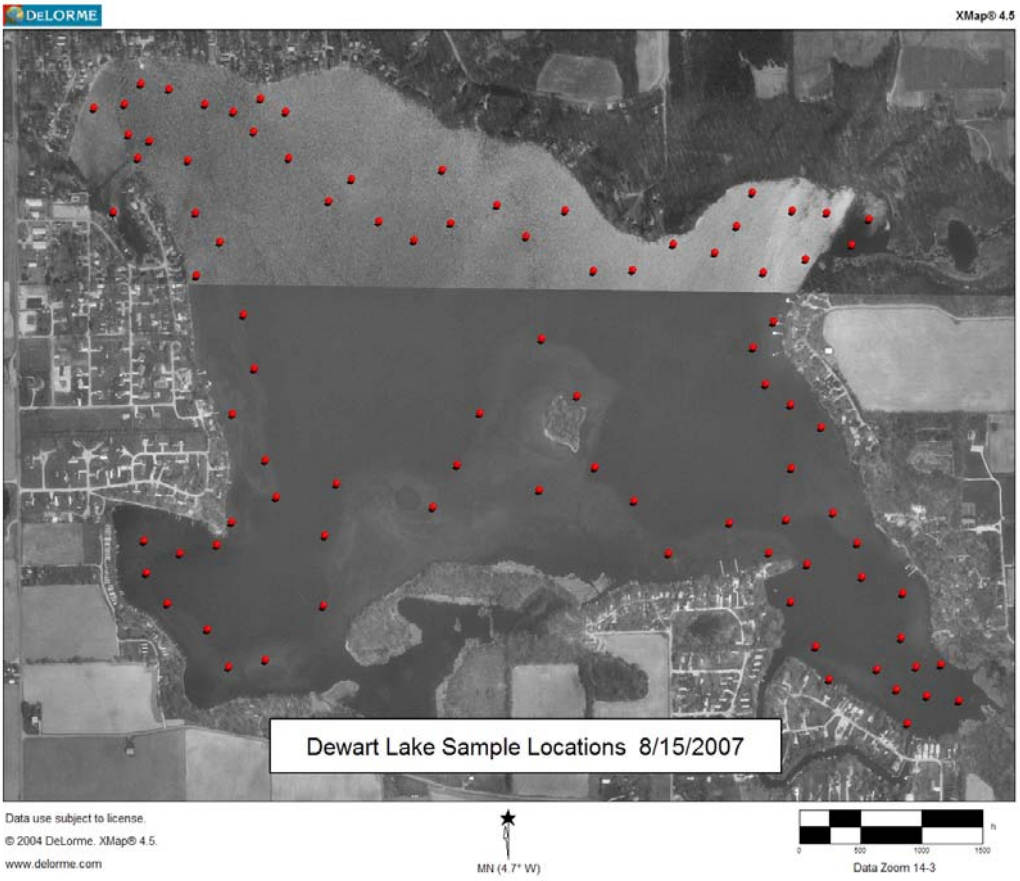
Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

8.2 Tier II Results

Secchi depth was measured at 7.8 feet in August 15, 2007 Tier II survey. Based on Dewart Lake's classification as mesotrophic and its 551 surface acres, ninety rake samples were divided between each 5 foot depth contour of the littoral zone. A total of 13 species of submersed aquatic plants were collected during this survey. Brittle naiad was the only invasive plant found in this survey. The following map shows the locations of all sample sites during the 2007 Tier II survey. Sample locations are the same as 2006, and are stratified by depth contour. Figure 4 shows the 2007 rake sample locations.

Figure 4: 2007 Rake Sample Locations



Tier II Data Analysis

The following tables are data summaries for the 2007 aquatic vegetation survey. These tables help to describe the plant community, and will help identify any changes that take place in the years to come. Tables labeled "Overall" include every sample site in the survey, while the other tables describe each 5 foot depth contour of the lake's littoral zone (0-5 feet, 5-10 feet, etc).

Table 4: August 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Dewart Lake	Secchi:	7.8	SE Mean Species/site:	0.13
Date:	8/15/07	Littoral sites with plants:	61	Mean natives/site:	1.31
Littoral depth (ft):	14.0	Number of species:	13	SE Mean natives/site:	1.12
Littoral sites:	79	Maximum species/site:	4	Species diversity:	0.79
Total sites:	90	Mean number species/site:	1.34	Native diversity:	0.78

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Chara	51.1	10.0	25.6	15.6	32.9
Sago Pondweed	28.9	5.6	7.8	15.6	21.3
Water Stargrass	13.3	3.3	7.8	2.2	7.6
Curly-leaf Pondweed	8.9	7.8	1.1	0.0	2.2
Slender Naiad	6.7	5.6	1.1	0.0	1.8
Coontail	5.6	0.0	5.6	0.0	3.3
Large-leaf Pondweed	4.4	2.2	2.2	0.0	1.8
Small Pondweed	4.4	4.4	0.0	0.0	0.9
Brittle Naiad	3.3	2.2	0.0	1.1	1.6
Flat-stemmed Pondweed	3.3	1.1	2.2	0.0	1.6
American Pondweed	2.2	2.2	0.0	0.0	0.4
Leafy Pondweed	1.1	1.1	0.0	0.0	0.2
Nitella	1.1	1.1	0.0	0.0	0.2
Filamentous Algae	10.0				

Table 5: August 2007 Data Analysis 0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet

Lake:	Dewart Lake	Secchi:	7.8	SE Mean Species/site:	0.16
Date:	8/15/07	Littoral sites with plants:	29	Mean natives/site:	1.69
Littoral depth (ft):	14.0	Number of species:	11	SE Mean natives/site:	0.13
Littoral sites:	29	Maximum species/site:	4	Species diversity:	0.71
Total sites:	29	Mean number species/site:	1.69	Native diversity:	0.71

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Chara	86.2	0.0	41.4	44.8	69.7
Waterstargrass	17.2	6.9	6.9	3.4	9.0
Large-leaf Pondweed	13.8	6.9	6.9	0.0	5.5
Sago Pondweed	13.8	10.3	3.4	0.0	4.1
Coontail	10.3	0.0	10.3	0.0	6.2
Curly-leaf Pondweed	6.9	6.9	0.0	0.0	1.4
Small Pondweed	6.9	6.9	0.0	0.0	1.4
Flat-stemmed Pondweed	3.4	0.0	3.4	0.0	2.1
American Pondweed	3.4	3.4	0.0	0.0	0.7
Leafy Pondweed	3.4	3.4	0.0	0.0	0.7
Nitella	3.4	3.4	0.0	0.0	0.7
Brittle Naiad	0.0	0.0	0.0	0.0	0.0
Filamentous Algae	10.3				

Table 6: August 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Dewart Lake	Secchi:	7.8	SE Mean Species/site:	0.24
Date:	8/15/07	Littoral sites with plants:	21	Mean natives/site:	1.63
Littoral depth (ft):	14.0	Number of species:	9	SE Mean natives/site:	0.21
Littoral sites:	27	Maximum species/site:	4	Species diversity:	0.78
Total sites:	27	Mean number species/site:	1.74	Native diversity:	0.75

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Chara	59.3	22.2	33.3	3.7	28.1
Sago Pondweed	48.1	0.0	11.1	37.0	43.7
Slender Naiad	22.2	18.5	3.7	0.0	5.9
Water Stargrass	11.1	0.0	11.1	0.0	6.7
Brittle Naiad	11.1	7.4	0.0	3.7	5.2
Curly-leaf Pondweed	11.1	11.1	0.0	0.0	2.2
Coontail	3.7	0.0	3.7	0.0	2.2
Flat-stemmed Pondweed	3.7	0.0	3.7	0.0	2.2
Small Pondweed	3.7	3.7	0.0	0.0	0.7
Filamentous Algae	3.7				

Table 7: August 2007 Data Analysis 10 - 15 Feet

Occurrence and Abundance of Submersed Aquatic Plants 10-15 Feet					
Lake:	Dewart Lake	Secchi:	7.8	SE Mean Species/site:	0.29
Date:	8/15/07	Littoral sites with plants:	11	Mean natives/site:	1.04
Littoral depth (ft):	14.0	Number of species:	8	SE Mean natives/site:	0.29
Littoral sites:	23	Maximum species/site:	4	Species diversity:	0.78
Total sites:	24	Mean number species/site:	1.04	Native diversity:	0.78

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Sago Pondweed	37.5	8.3	12.5	16.7	25.8
Chara	20.8	12.5	8.3	0.0	7.5
Water Stargrass	16.7	4.2	8.3	4.2	10.0
Curly-leaf Pondweed	12.5	8.3	4.2	0.0	4.2
Coontail	4.2	0.0	4.2	0.0	2.5
American Pondweed	4.2	4.2	0.0	0.0	0.8
Flat-stemmed Pondweed	4.2	4.2	0.0	0.0	0.8
Small Pondweed	4.2	4.2	0.0	0.0	0.8
Filamentous Algae	20.8				

No plants were found deeper than 14 feet in 2007.

Table 8 was provided by District 3 Fisheries Biologist Jed Pearson and provides a comparison of recent survey data from both the IDNR and Aquatic Weed Control. Data was similar between surveys, showing Eurasian watermilfoil, chara and coontail all being frequently collected before the whole lake Sonar treatment.

Table 8: Dewart Lake Survey Comparison

Dewart Lake 3-year summary

Parameter (0-20 ft)	AWC	AWC	AWC	DFW	DFW	DFW	DFW	DFW	DFW	Target
Date	7/27/05	8/10/06		5/24/05	5/23/06	5/23/07	8/1/05	7/31/06	8/1/07	
Sample sites (n)	80	90		106	90	90	102	90	90	90
Secchi (ft)	13.0	8.0		21.0	22.0	13.0	7.5	11.0	9.0	10.0
Littoral depth (ft)	19.0	20.0		26.5	19.0	20.0	21.0	20.0	17.0	20.0
Coverage (%)	93.8	83.3		96.2	92.2	87.8	100.0	88.9	85.6	>80.0
Native coverage (%)				94.3	75.6	55.6	97.1	88.9	83.3	>80.0
Species (N)	13	11		12	11	9	17	10	12	13
Native species (N)	11	10		10	9	8	15	9	11	13
Species/site (max)	7	5		6	4	4	6	3	4	5
Species/site (mean)	2.14	1.18		2.35	1.98	1.18	2.49	1.14	1.64	2.00
Native species/site (mean)	1.78	1.10		1.46	0.94	0.69	1.87	1.12	1.40	1.50
Species diversity	0.84	0.77		0.85	0.79	0.73	0.85	0.72	0.79	0.80
Native species diversity	0.80	0.74		0.82	0.73	0.72	0.84	0.71	0.75	0.80
Species occurrence (%)	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**Target**
Eurasian water milfoil	35.0			56.6	67.8		59.8			
Chara	65.0	33.3		40.6	23.3	30.0	51.0	37.8	56.7	
Coontail	15.0	43.3		34.0	41.1	5.6	43.1	43.3	12.2	
Water stargrass		11.1			5.6	5.6	18.6	16.7	16.7	
Common naiad	18.8			9.4	2.2		18.6	2.2	5.6	
Sago pondweed	12.5	4.4			10.0	17.8	12.7		35.6	
Illinois pondweed	23.8	4.4					11.8		1.1	
Variable pondweed				5.7	6.7	1.1	13.7	2.2	2.2	
Elodea	1.3			1.9			3.9			
Long-leaf pondweed				15.1						
Large-leaf pondweed	5.0	3.3			2.2	4.4	5.9	2.2	3.3	
Floating-leaf pondweed							1.0			
Flat-stem pondweed	22.5	2.2		21.7	2.2	1.1	2.9	5.6		
Curly-leaf pondweed	1.3	7.8		32.1	35.6	48.9	2.0	2.2	24.4	
Bladderwort				0.9			1.0			
Eel grass	5.0	1.1		3.8			1.0	1.1	1.1	
Leafy pondweed							1.0			
Northern water milfoil				13.2			1.0			
American pondweed	6.3	4.4								
Whorled water milfoil	2.5									
Spiny naiad									4.4	
Nitella		2.2			1.1	3.3		1.1	1.1	
Filamentous algae				17.0	12.2	34.4	9.7	12.2	12.2	
Species dominance	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**Target**
Eurasian water milfoil	16.8			29.8	44.7		37.1			
Chara	41.5	29.3		18.7	10.9	10.4	36.5	23.1	28.7	
Coontail	3.5	22.9		10.9	18.4	1.1	24.7	17.6	2.9	
Water stargrass		5.8			1.1	1.1	8.8	3.3	6.4	
Common naiad	6.5			1.9	0.9		5.7	0.9	1.1	
Sago pondweed	2.8	1.3			2.0	4.4	5.7		19.1	
Illinois pondweed	6.0	0.9					4.3		0.2	
Variable pondweed				1.1	1.3	0.2	3.9	0.4	0.4	
Elodea	0.3			1.1			2.4			
Long-leaf pondweed				3.4						
Large-leaf pondweed	1.5	2.0			1.3	0.9	2.7	0.4	1.6	
Floating-leaf pondweed							1.0			
Flat-stem pondweed	5.3	0.4		7.0	0.9	0.2	1.0	1.1		
Curly-leaf pondweed	0.5	1.6		12.5	20.9	24.0	0.4	0.4	5.3	
Bladderwort				0.2			0.2			
Eel grass	1.0	0.2		1.1			0.2	0.2		
Leafy pondweed							0.2		0.2	
Northern water milfoil				2.6			0.2			
American pondweed	3.3	0.9								
Whorled water milfoil	0.5									
Spiny naiad									0.9	
Nitella		1.8			0.7	1.1		0.2	0.2	

Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{(\#\text{ of sites where the species was collected}) \times 100}{\text{Total \# of littoral sample sites}}$$

Table 9 shows overall site frequencies for each plant collected in the 2007 Tier II vegetation survey. Chara was the most frequently collected species, followed by sago pondweed and water stargrass. Eurasian watermilfoil was not found in Dewart Lake in 2007.

Table 9: 2007 Site Frequencies

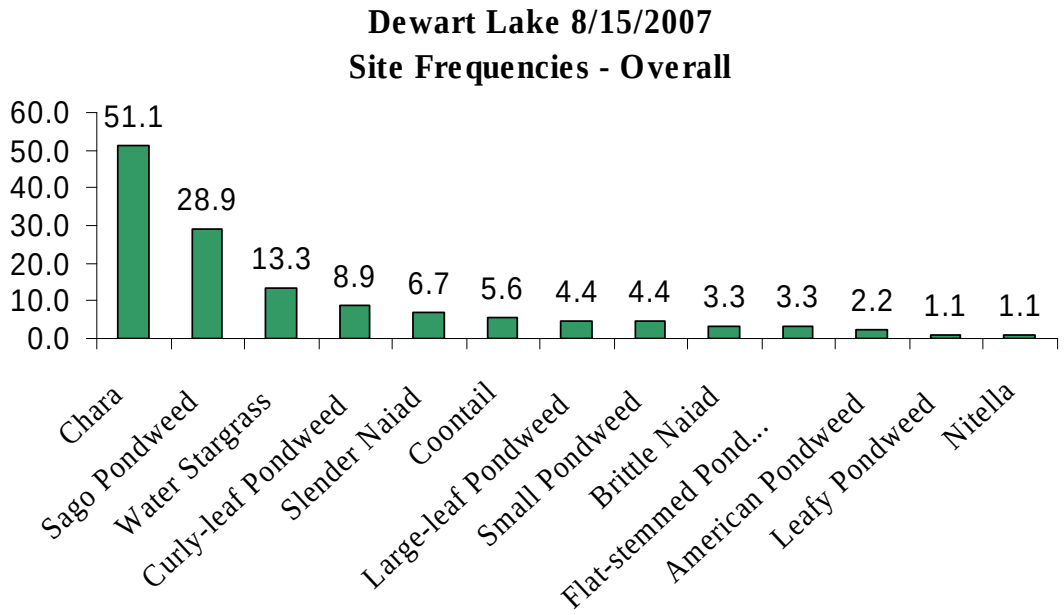
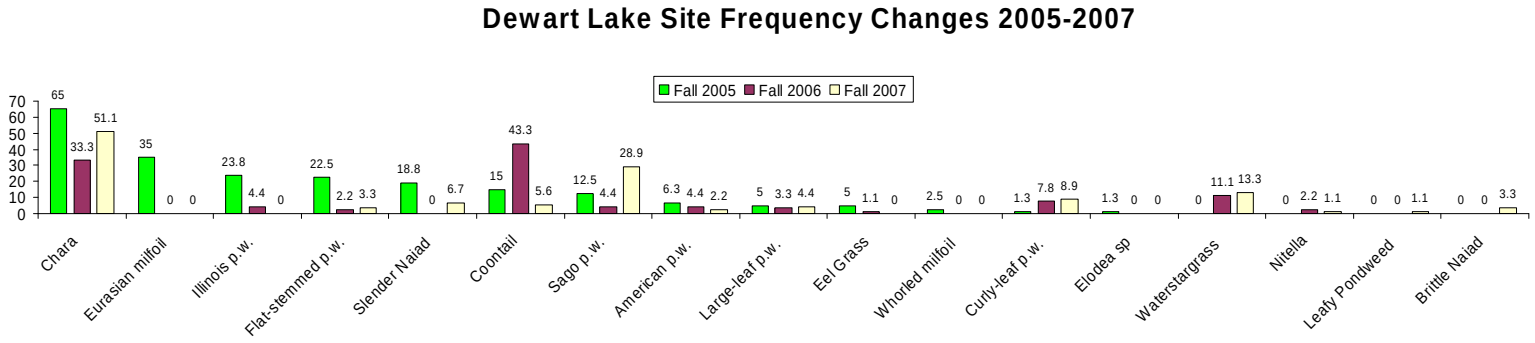


Table 10 shows site frequencies for every plant collected in fall 2005 (pre-treatment) or fall 2006 or 2007 (post treatment). Tier II survey protocol was changed in 2006, shifting more sample sites to deep water, and that change should be taken into consideration when viewing this information. The most significant changes over this 3 year period have been in the coontail and sago pondweed populations. Coontail frequency has diminished after treatment, while sago pondweed frequency has increased after the Sonar treatment.

Table 10: Dewart Lake Site Frequency History



Species Diversity

The species diversity indices listed in data analysis tables help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

The overall species diversity index for Dewart Lake in late season 2007 was 0.79, up slightly from 0.77 in 2006. Native plant diversity in late season of 2007 was less than the overall species diversity at 0.78, meaning invasive species (curly leaf pondweed, and brittle naiad) accounted for some of the diversity in Dewart Lake.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 11 shows dominance scores for all plants collected in the 2007 Tier II aquatic vegetation survey. Chara had the highest dominance score, followed by sago pondweed and water stargrass. Coontail dominance dropped sharply from 22.9 in 2006, to 3.3 in 2007.

Table 11: 2007 Species Dominance

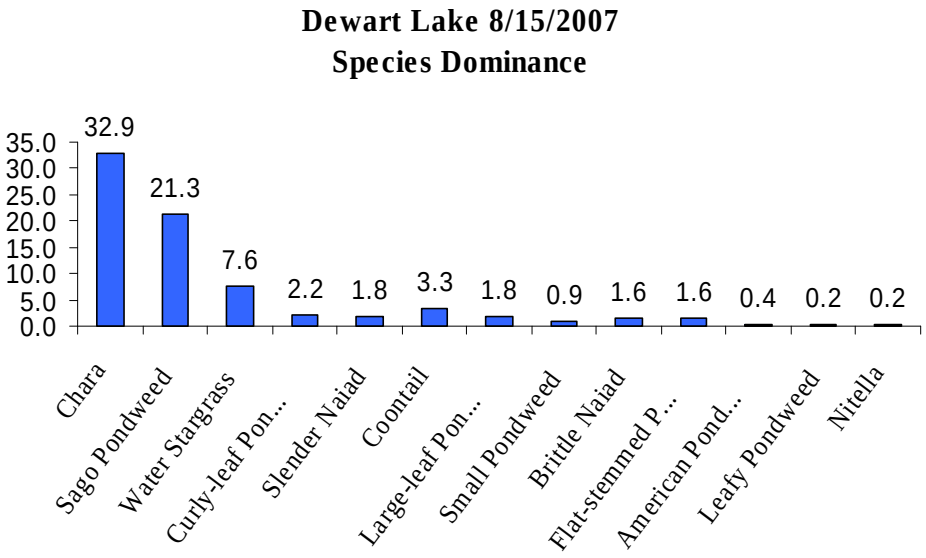
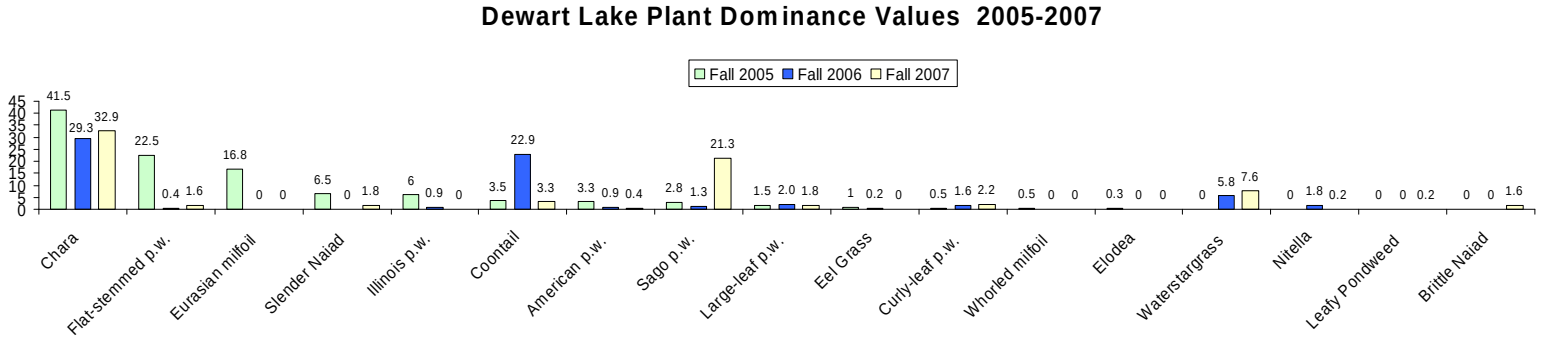


Table 12 tracks dominance values for each plant collected at Dewart Lake during its involvement in the LARE program. Trends are similar to sight frequency, with Eurasian watermilfoil dominance dropping to 0 after the Sonar treatment and remaining at 0 through the 2007 growing season.

Table 12: Dewart Lake Plant Dominance History



8.3 Macrophyte Inventory Discussion

The submersed plant community of Dewart Lake covers roughly 260 acres of the lake, or 47% of the lake's total surface area. Eurasian watermilfoil was dominant in about 140 of these acres before the Sonar treatment. After treatment, Eurasian watermilfoil was reduced to the point that it was undetectable in fall of 2006 and 2007. After treatment in 2006, slight reductions were seen in overall species richness and plant diversity, and populations of some native plants were reduced. In 2007, species richness increased to 13 species and many native populations were increasing. Sago pondweed increased rapidly in areas previously infested by EWM. Its dominance score increased from 1.3 in

2006, to 21.3 in 2007. Coontail showed a large decrease in site frequency from 43.3 % in 2006 to just 5.6% in 2007.

When compared to Pearson's study of 21 Indiana Lakes, Dewart Lake is characterized by above average species richness with 13 species and above average species diversity (0.79). Native plant species such as sago pondweed, slender naiad, and water stargrass have increased in abundance since 2006. Curly leaf pondweed, an invasive plant species also showed a minor site frequency increase (7.8 to 8.9) since 2006.

Although EWM was not found in 2007, some re-growth is expected in 2008 based on observations from other whole lake Sonar treatments in northern Indiana. The plant community should continue to be monitored to identify any areas of EWM re-growth.

9.0 Aquatic Vegetation Management Alternatives

Major Eurasian watermilfoil control practices have not changed significantly from the 2005 Alternatives.

10.0 Public Involvement

A LARE meeting was held on November 8, 2007 to discuss issues pertaining to Dewart Lake. District 3 Fisheries Biologist Jed Pearson, a lake representative, Aquatic Weed Control and LARE Aquatic Biologist Angela Sturdevant were all present and discussed the plant community of Dewart Lake.

A public lake meeting was held for Dewart Lake on June 10, 2007, Thirty one people were in attendance. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the future management strategy for maintaining the Eurasian watermilfoil population at a low level with spot herbicide treatments.
A summary of responses to the questionnaire (Table 13) as well as public comments are shown in Appendix 16.6.

Table 13: Public Questionnaire

Lake Use Survey (31 total) Lake name Dewart Lake

Are you a lake property owner? Yes 31 No 0

Are you currently a member of your lake association? Yes 26 No 3

How many years have you been at the lake?
2 or less-1
2 – 5 years-1
5-10 years-1
Over 10 years-24

How do you use the lake (mark all that apply)

24 Swimming	6 Irrigation
28 Boating	1 Drinking water
27 Fishing	1 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 11 No 19

Do you currently participate in a weed control project on the lake? Yes 18 No 11

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 11 No 19

Does the level of vegetation in the lake affect your property values? Yes 10 No 19

Are you in favor of continuing efforts to control vegetation on the lake? Yes 30 No 1

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 26 No 5

Mark any of these you think are problems on your lake:

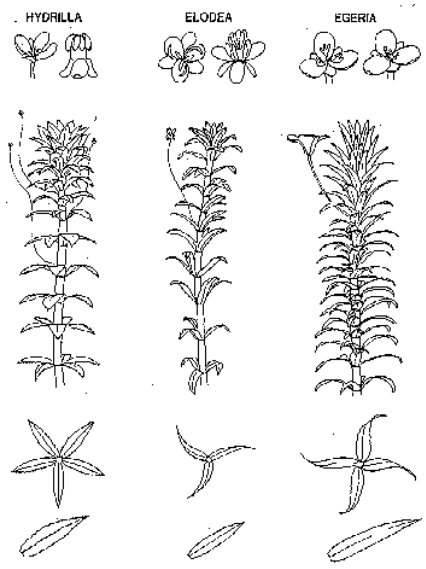
11 Too many boats access the lake
20 Use of jet skis on the lake
6 Too much fishing
5 Fish population problem
9 Dredging needed
9 Overuse by nonresidents
5 Too many aquatic plants
0 Not enough aquatic plants
4 Poor water quality
3 Pier/funneling problem

Please add any comments:
See next page

11.0 Public Education

11.1 Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is federally listed as a noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Management Action Strategy

Eurasian watermilfoil was not found in Dewart Lake in 2007. Some areas of re-growth are expected in 2008 based on observations from other whole lake Sonar treatments. Any areas of Eurasian watermilfoil re-growth should be identified and treated with Renovate herbicide (active ingredient: triclopyr) in 2008. A vegetation control permit will be submitted without a treatment map for 2008, since no re-growth has occurred to this point. If Eurasian watermilfoil returns to the lake in 2008, it will be detected in the vegetation surveys, and spot treatments using Renovate or 2, 4-D would be used to control the EWM. Renovate has shown the ability to provide 2 years of control in some situations. However, 2 years of control for spot treatments is not expected.

Maintenance of the Eurasian watermilfoil population should be the highest priority. Spot herbicide treatments should be limited to areas of Eurasian watermilfoil infestation to protect the native species that are re-colonizing the lake. Treatment of native plants on the main lake is not likely to be permitted in 2007. This should give the native plants a competitive advantage over Eurasian watermilfoil.

Herbicide Treatment Specifications

If 2, 4-D is used for herbicide treatments, then a concentration of 1.76 parts per million should be used to ensure adequate control. If Renovate is used, then the concentration should be between 1.0 and 1.5 parts per million.

13.0 Project Budget

*All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.

1. Chemically treat areas of Eurasian milfoil growth
   A. Treat up to 20 acres for Eurasian milfoil with Renovate or 2, 4-D $9,500

2. Conduct a spring visual survey and late season aquatic vegetation survey to monitor both Eurasian milfoil and native plant populations.

   A. Aquatic Vegetation Surveys and Plan Update Up to $6,000

14.0 Monitoring and plan Update Procedures

In 2008 Aquatic Weed Control will conduct a spring visual vegetation survey to search for areas of Eurasian watermilfoil re-growth. Should any areas of re-growth be found, a treatment map will be submitted to the IDNR. Spot treatments for the control of Eurasian watermilfoil would follow the approval of the submitted treatment map. A late season Tier II aquatic vegetation survey will also be conducted to evaluate both native and invasive plant populations. These surveys should help to detect any areas of Eurasian watermilfoil re-growth and will also document changes in the native plant community, as well as provide more data on the response of plant populations to whole lake Sonar treatments.

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16.0 Appendices

16.1 Calculations

Fluridone Calculations:
The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:
Quarts of Sonar A.S. required per treated surface acre = Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027
For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:
5 **x** 25 **x** 0.0027 = 0.33 quarts per treated surface acre
When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured **x** 32. For example, 0.33 quarts **x** 32 = 10.5 fluid ounces.
Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

The following chart outlines rate calculations for DMA – 4 IVM Herbicide. It was taken directly from the DMA – 4 IVM specimen label on Dow AgroSciences website.
http://www.dowagro.com/ivm/invasive/prod/dma.htm

Submerged Aquatic Weeds: Including Eurasian Water Milfoil *(Myriophyllum spicatum)*

Treatment Site	Maximum Application Rate †	Specific Use Directions
Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	**Application Timing:** For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas. **Subsurface Application:** Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift. **Surface Application:** Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre. **Aerial Application:** Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).

†DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	Average Depth (ft)	2,4-D Acid Equivalent to Apply (lb/acre)	Amount of DMA 4 IVM to Apply (gal/acre)
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

The following table outlines rate calculations for Renovate 3 herbicide based on desired PPM and average depth of treatment area. It is taken directly from the Renovate 3 specimen label on SePRO Corporation's website: www.sepro.com

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

16.2 Common Aquatic Plants of Indiana

(See 2005 Dewart Lake Management Plan)

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 14: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.4 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.5 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:

(1) A privately owned lake, farm pond, or public or private drainage ditch.

(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:

(A) The area where vegetation is to be controlled does not exceed:

(i) twenty-five (25) feet along the legally established, average, or normal shoreline;

(ii) a water depth of six (6) feet; and

(iii) a total surface area of six hundred twenty-five (625) square feet.

(B) Control of vegetation does not occur in a public waterway of the state.

(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.

(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.

(d) This section does not do any of the following:

(1) Act as a bar to a suit or cause of action by a person or governmental agency.

(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.

(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).

As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits

Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.

(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:

(1) The common name of the plants to be controlled.

(2) The acreage to be treated.

(3) The maximum depth of the water where plants are to be treated.

(4) The name and amount of the chemical to be used.

(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.
(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.6 Public Questionnaire Summary

Lake Use Survey (31 total) Lake name Dewart Lake

Are you a lake property owner? Yes 31 No 0

Are you currently a member of your lake association? Yes 26 No 3

How many years have you been at the lake?
2 or less - 1
2 – 5 years - 1
5-10 years - 1
Over 10 years - 24

How do you use the lake (mark all that apply)

24 Swimming	6 Irrigation
28 Boating	1 Drinking water
27 Fishing	1 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 11 No 19

Do you currently participate in a weed control project on the lake? Yes 18 No 11

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 11 No 19

Does the level of vegetation in the lake affect your property values? Yes 10 No 19

Are you in favor of continuing efforts to control vegetation on the lake? Yes 30 No 1

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 26 No 5

Mark any of these you think are problems on your lake:

11 Too many boats access the lake
20 Use of jet skis on the lake
6 Too much fishing
5 Fish population problem
9 Dredging needed
9 Overuse by nonresidents
5 Too many aquatic plants
0 Not enough aquatic plants
4 Poor water quality
3 Pier/funneling problem

Please add any comments:
See next page

Dewart Lake Public Written Comments – June 10, 2007

Remove northern Pike.
Lake Patrol, water skiing after sunset with no observer.
High speed boating next to shore.
Speed Restrictions around Scout Camp

Cattails in front of Dock on South Side.
Dredge South Side due to not being able to get boats out.

Need to control skiers and jet skis to protect shoreline.

There needs to be more control of the number of boats at the public access.
The DNR needs to respond to every inquiry about easement encroachment! They need to not be afraid of investigating all inquiries. Called three DNR officers and never received a response.

Clear, clean water is a concern of mine.
Need to have rules to control use of jet skis on the lake.
Water quality is not as good as 5 years ago.
Lake front property owners are covering the entire shoreline with piers.
Need Eco-Zone of South Side.
Reeds are disappearing and bottom of lake scouring.
Private piers need to be limited.

People don't follow the law.
Ski Boats and jet skis too close to shore.

Too high speed wave runners, need more evening lake patrol-skiing without observer.
Boating too close to shore, even with bouys.
Need no wake zone in northeast corner around scout camp and is causing shoreline erosion.
Scout camp is a great neighbor and would help to have a great area for pontoon and boat anchoring for swimming and relaxation! And safety for campers and swimmers.
Boats high speed disregard everyone! Thanks.

16.7 Species Distribution Maps

Figure 5: August 2007 Sample Locations

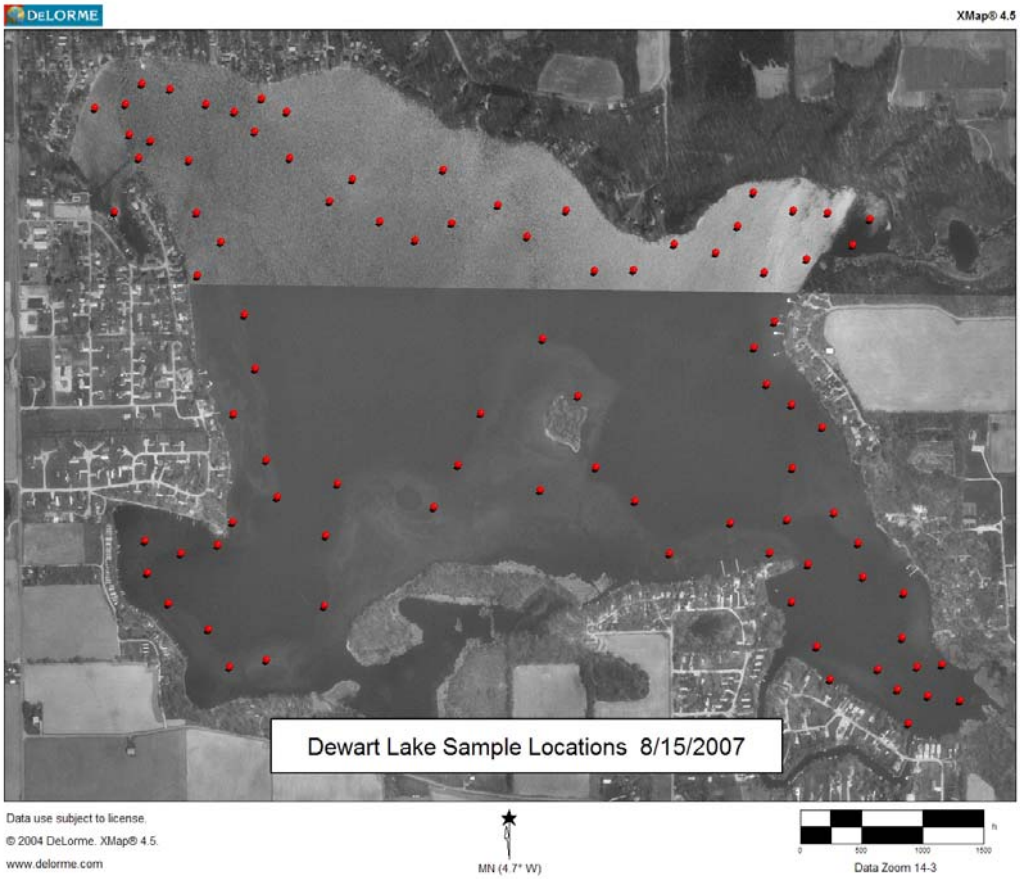


Figure 6: August 2007 Water Stargrass Locations

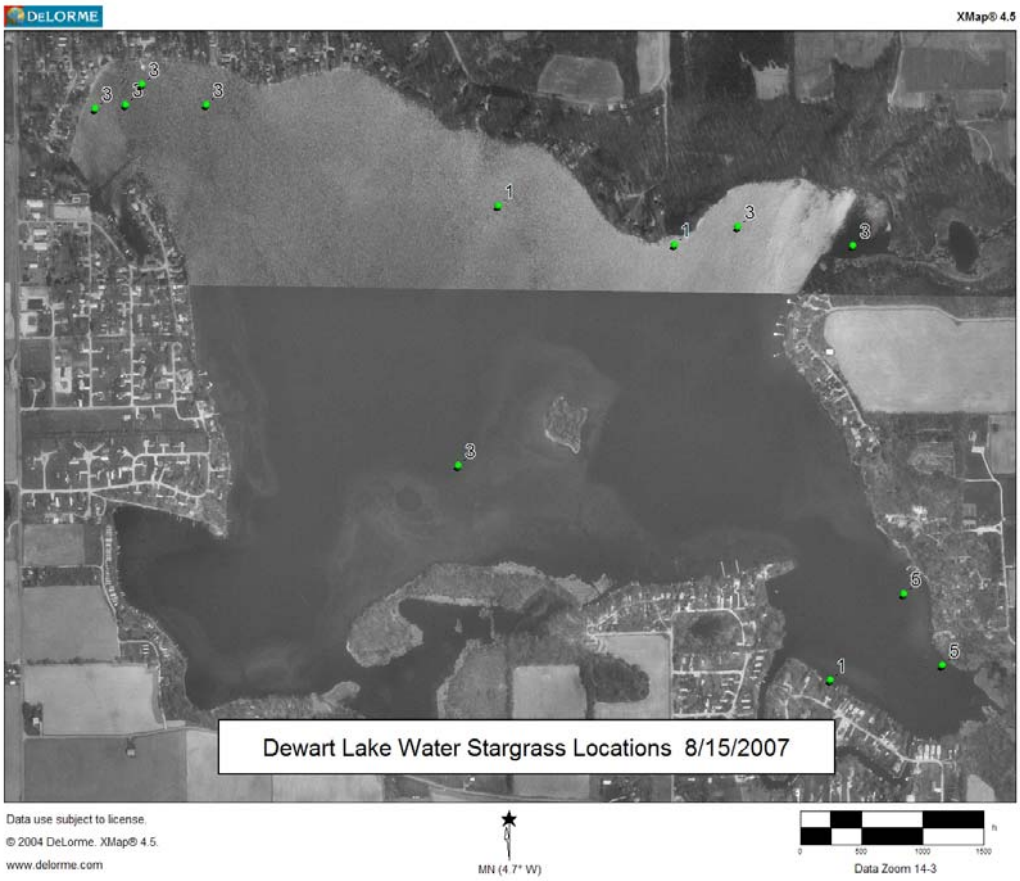


Figure 7: August 2007 American Pondweed Locations

Figure 8: August 2007 Brittle Naiad Locations

Figure 9: August 2007 Chara Locations

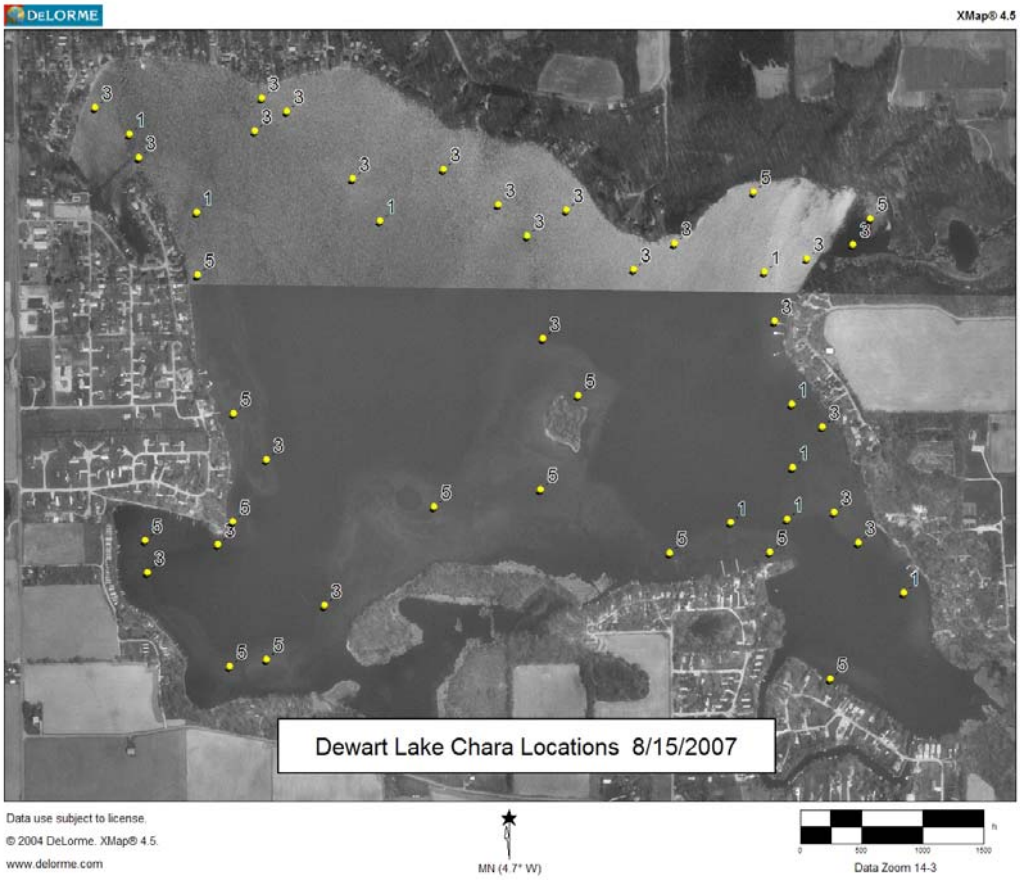


Figure 10: August 2007 Coontail Locations

Figure 11: August 2007 Curly Leaf Pondweed Locations

Figure 12: August 2007 Flat-Stemmed Pondweed Locations

Figure 13: August 2007 Large Leaf Pondweed Locations

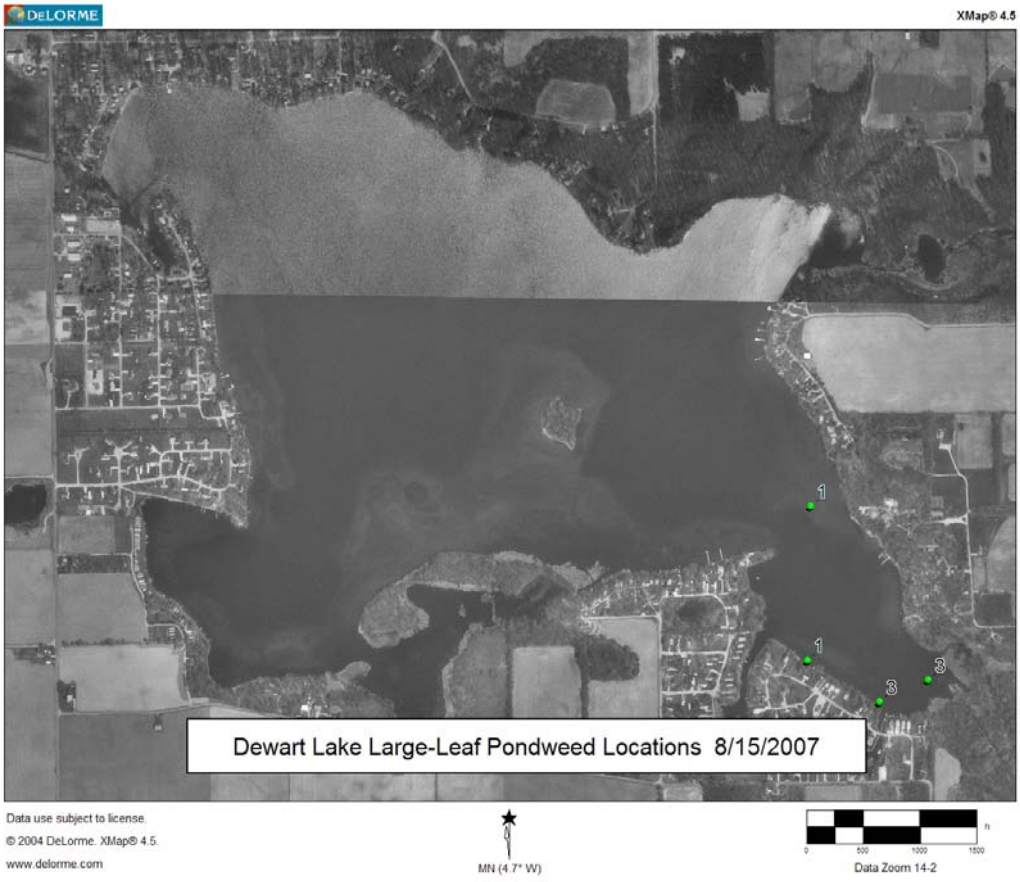


Figure 14: August 2007 Leafy Pondweed Locations

Figure 15: August 2007 Nitella Locations

Figure 16: August 2007 Sago Pondweed Locations

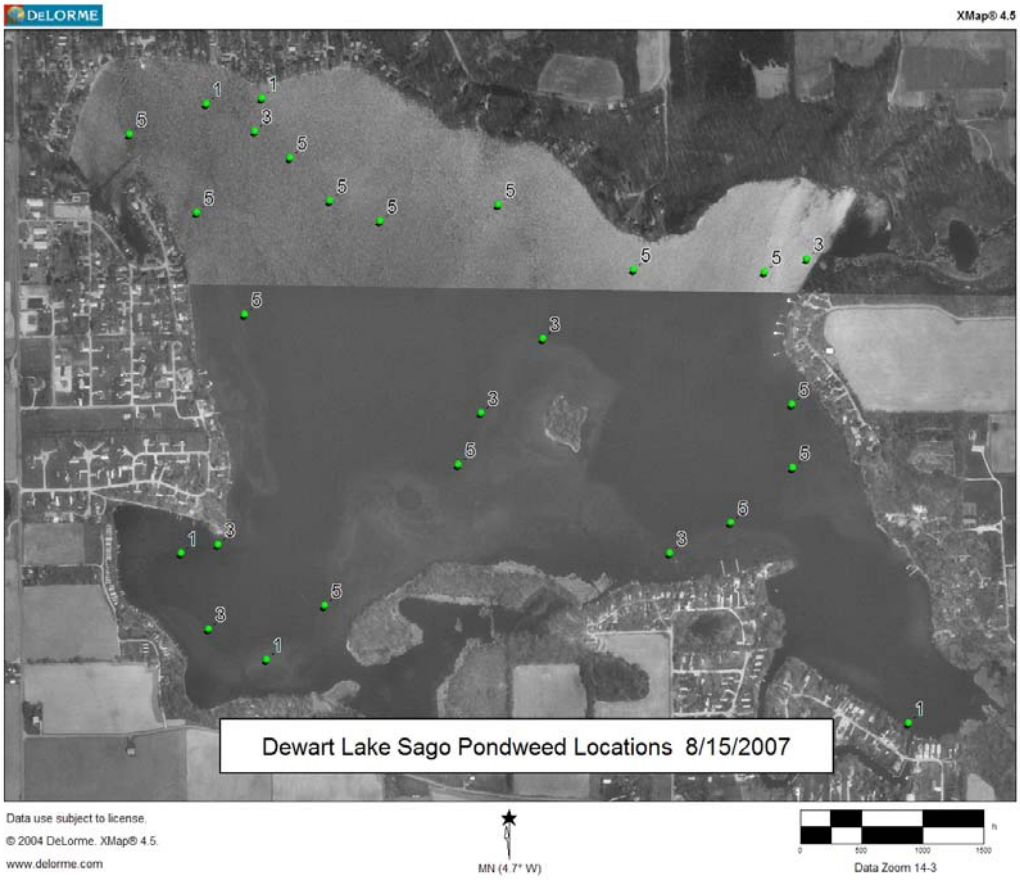


Figure 17: August 2007 Slender Naiad Locations

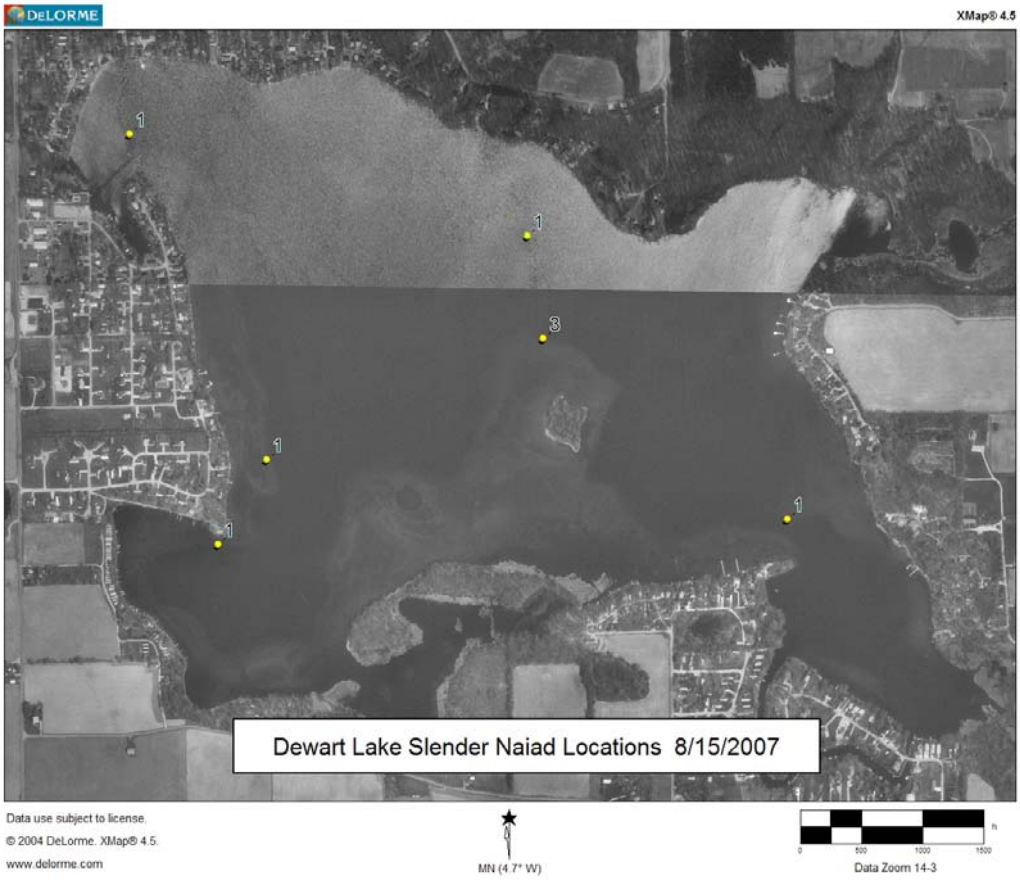
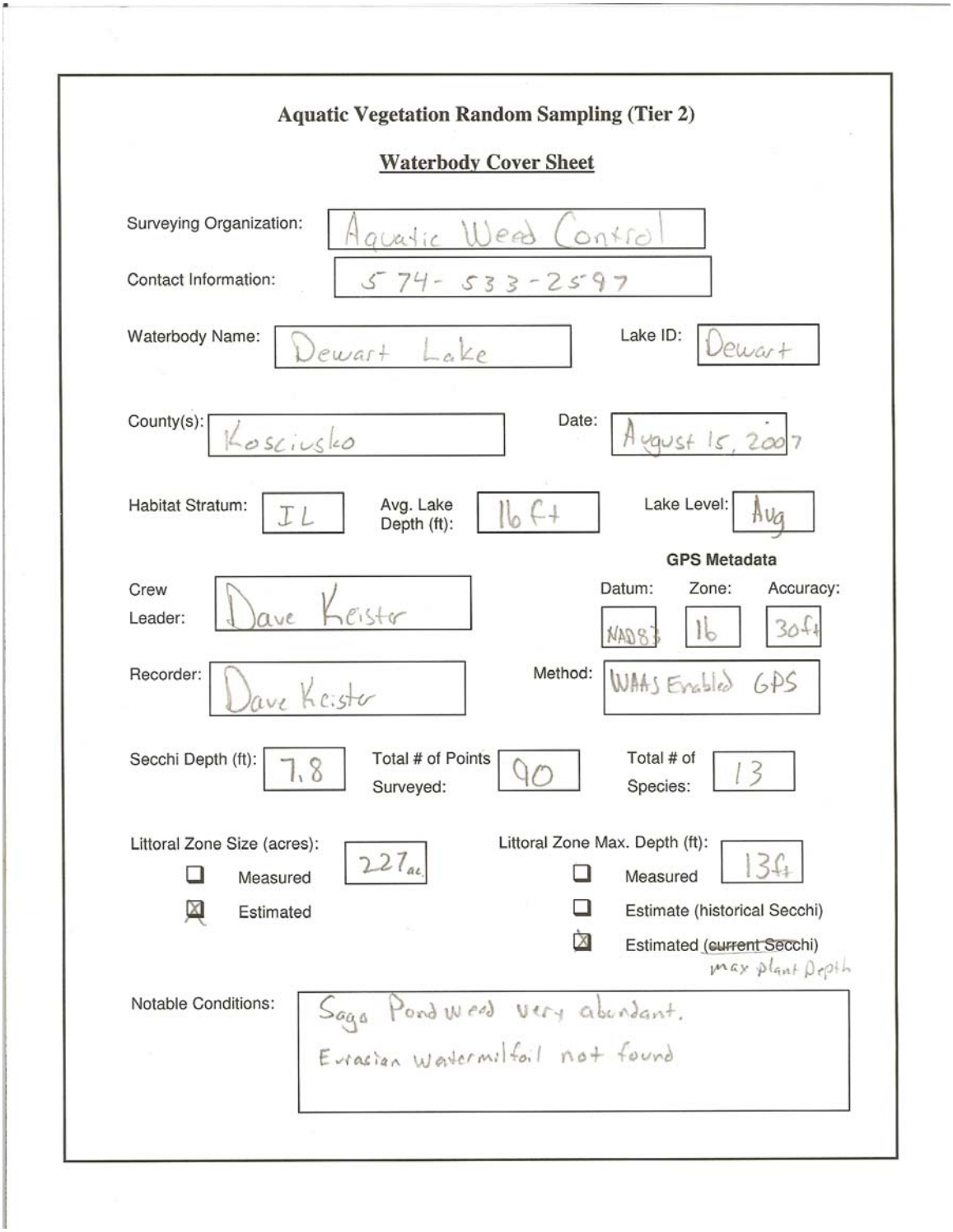


Figure 18: August 2007 Small Pondweed Locations

16.8 Data Sheets



Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization: Aquatic Weed Control

Contact Information: 574-533-2597

Waterbody Name: Dewart Lake

Lake ID: Dewart

County(s): Kosciusko

Date: August 15, 2007

Habitat Stratum: IL

Avg. Lake Depth (ft): 16 ft

Lake Level: Avg

GPS Metadata

Crew Leader: Dave Keister

Datum: NAD83

Zone: 16

Accuracy: 30ft

Recorder: Dave Keister

Method: WAAS Enabled GPS

Secchi Depth (ft): 7.8

Total # of Points Surveyed: 90

Total # of Species: 13

Littoral Zone Size (acres): 227 ac

- ☐ Measured
- ☒ Estimated

Littoral Zone Max. Depth (ft): 13ft

- ☐ Measured
- ☐ Estimate (historical Secchi)
- ☒ Estimated ~~(current Secchi)~~ max plant Depth

Notable Conditions: Sago Pondweed very abundant.
Eurasian Watermilfoil not found

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 1 of 4

WATERBODY NAME: Dewart lake	DATE: August 15, 2007
COUNTY: Kosciusko County	SECCHI DEPTH (FT): 7.8 ft
SITE ID: Dewart	MAX PLANT DEPTH (FT): 13 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: overcast, Temp lower 80's
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes: CERDEM, CHARA, STUPEC, N ODFL, POTZOS, POTCRI, NITFLE, POTFOL

Point #	R/T	Latitude	Longitude	Depth	CERDEM	CHARA	STUPEC	N ODFL	POTZOS	POTCRI	NITFLE	POTFOL	A/C Notes
-7	R	GPS Points	1	3	3						1		P
			2	3		3						1	
			3	8	–								
			4	12		1	5		1	1			
			5	17	–							--	
			6	4		5							
			7	7			5						
			8	12	–								
			9	3		5							
			10	6		3		1					
			11	14	–								
			12	2		5							
			13	6		3	3	1					
			14	11			1						
			15	1		5							
			16	8		3							
			17	17	–								
			18	12			3						
			19	3		5							Small - 1
			20	2		5	1						
			21	6		3	5						
			22	12	–								
			23	18	–								
			24	2		5							
			25	9			5						Star - 3
			26	13			3						
			27	3		5							
			28	8		3	3	3					
			29	3		5							
			30	13	–								
			31	10	–								
			32	3		5	3						
			33	9		1	5						Brittle - 1 Small

Other plant species observed at lake:

Aquatic Weed Control

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 2 of 4

WATERBODY NAME: Dewart Lake	DATE: August 15 2007
COUNTY: Kosciusko County	SECCHI DEPTH (FT): 7.8 ft
SITE ID: Dewart	MAX PLANT DEPTH (FT): 13 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Overcast
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Point #	R/T	Latitude	Longitude	Depth	Species Codes: CERDEM	CHARA	STUPEC	NAJFLE	POT20S	POICRI	NITIDU	POTFOL	Notes
→	R	GPS Points	34	3		5							small-1
			35	9	-								
			36	13	-								P
			37	20	-								
			38	2		5							LARGE-1 star-1
			39	7	-								
			40	11	-								
			41	3			1			1			P LARGE-3
			42	8	-								P
			43	3									P LARGE-1
			44	3	3					1			STAR-5
			45	19	-								
			46	11									
			47	12		1							STAR-5
			48	16	-								
			49	10		3							
			50	4		3							LARGE-1
			51	8		1		1					Bristle-5
			52	12		1	5			1			P
			53	4		3							
			54	7		1	5						Pr. Alle-1 star.
			55	11	-								
			56	17	-								
			57	2		3							
			58	8		1	5						
			59	12		3	3						emerg/fan-1 small-1
			60	9	3	3			3				star-3
			61	6	3	5				1			
			62	11	-								
			63	16	-								
			64	4		5							
			65	9	-								star-3
			66	13	-								

Other plant species observed at lake:

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 3 of 4

WATERBODY NAME: Dewart Lake	DATE: August 15, 2007
COUNTY: Kosciusko County	SECCHI DEPTH (FT): 7.8 ft
SITE ID: Dewart	MAX PLANT DEPTH (FT): 13 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Overcast
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Point #	R/T	Latitude	Longitude	Depth	Species Codes: CHARA	STUPEC	NAJFLE	POTZOS	POTRIC	POTPUS	NAJMAR	A/G Notes
→	R	GPS Points	67	3	3					1		Star - 1 Am-1
			68	8	3	5						
			69	13	—							
			70	3	3							
			71	8	3		1		1		3	
			72	11	3	5						Star-1
			73	13	—							
			74	4	3							
			75	19	—							
			76	6	1	5				1		
			77	2	3							
			78	8		5						
			79	13		5						P
			80	2	3							
			81	6	3	3		3				
			82	19	—							
			83	3	3							
			84	14		1						Star-3
			85	9	—							
			86	11	3				3			P Star-3
			87	8					1			Star-3
			88	2	3				1			Star-3
			89	6	1	5	1					
			90	15	—							

Other plant species observed at lake:

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 4 of 4

WATERBODY NAME: Dewart Lake	DATE: August 15, 2007
COUNTY: Kosciusko County	SECCHI DEPTH (FT): 7.8
SITE ID: Dewart	MAX PLANT DEPTH (FT): 13 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Overcast
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Point #	Depth R/T	DO Latitude	Temp Longitude	Depth	Species Codes:								Notes
	0	8.40	82.3										
	1.5	8.39	82.2										
	3	8.42	82.2										
	4.5	8.42	82.1										
	6	8.41	81.7										
	7.5	8.34	81.6										
	9	8.26	81.6										
	10.5	8.24	81.5										
	12	8.06	81.4										
	13.5	7.52	81.2										
	15	5.93	79.8										
	16.5	4.64	78.6										
	18	3.67	77.4										
	19.5	1.58	74.6										
	21	0.25	71.7										
	22.5	0.23	69.7										
	24	0.28	67.6										
	25.5	0.67	64.8										
	27	0.07	62.4										
	28.5	0.04	61.0										
	30	0.03	58.7										
	31.5	0.02	57.7										
	33	0.02	56.6										

Other plant species observed at lake:

Rake Sample Location GPS Coordinates

Latitude	Longitude	site
41.37388	-85.7843	1
41.37508	-85.7836	2
41.37503	-85.7821	3
41.37386	-85.7819	4
41.37321	-85.7811	5
41.37245	-85.7818	6
41.3716	-85.7804	7
41.37038	-85.7801	8
41.36936	-85.7808	9
41.36833	-85.7798	10
41.36752	-85.7795	11
41.36695	-85.7808	12
41.36646	-85.7812	13
41.36626	-85.7823	14
41.36654	-85.7834	15
41.36583	-85.7833	16
41.36515	-85.7827	17
41.36457	-85.7815	18
41.36374	-85.7809	19
41.36388	-85.7798	20
41.36509	-85.7781	21
41.36666	-85.778	22
41.36782	-85.7777	23
41.3673	-85.7748	24
41.36824	-85.7741	25
41.36939	-85.7734	26
41.36767	-85.7716	27
41.37105	-85.7716	28
41.36977	-85.7705	29
41.36819	-85.77	30
41.36744	-85.7688	31
41.36625	-85.7678	32
41.36695	-85.766	33
41.36628	-85.7648	34
41.36602	-85.7637	35
41.36517	-85.7642	36
41.36418	-85.7634	37
41.36345	-85.763	38
41.36368	-85.7616	39
41.36323	-85.761	40
41.36247	-85.7607	41
41.36309	-85.7601	42
41.36298	-85.7592	43
41.36379	-85.7597	44
41.36374	-85.7604	45
41.36437	-85.7609	46
41.36536	-85.7608	47

41.36574	-85.7621	48
41.36649	-85.7622	49
41.36717	-85.7629	50
41.36701	-85.7643	51
41.36816	-85.7641	52
41.36908	-85.7633	53
41.36957	-85.7642	54
41.37003	-85.7649	55
41.37085	-85.7653	56
41.37143	-85.7647	57
41.37253	-85.765	58
41.37283	-85.7637	59
41.37313	-85.7624	60
41.37372	-85.7619	61
41.37386	-85.7631	62
41.37391	-85.7641	63
41.37431	-85.7653	64
41.37355	-85.7658	65
41.37298	-85.7664	66
41.37316	-85.7677	67
41.37258	-85.7689	68
41.37256	-85.77	69
41.37391	-85.7709	70
41.37334	-85.772	71
41.37403	-85.7729	72
41.37363	-85.7743	73
41.37482	-85.7745	74
41.37324	-85.7754	75
41.37367	-85.7764	76
41.3746	-85.7772	77
41.37412	-85.7779	78
41.37508	-85.7791	79
41.37612	-85.7792	80
41.37567	-85.7801	81
41.37611	-85.7807	82
41.37641	-85.7799	83
41.37628	-85.7816	84
41.37661	-85.7827	85
41.37673	-85.7835	86
41.37629	-85.784	87
41.3762	-85.7849	88
41.37561	-85.7839	89
41.37547	-85.7832	90

END

16.9 IDNR Vegetation Control Permit

To be included in the final report.